

## SWIFT FOX INVESTIGATIONS IN NEW MEXICO, 1999

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Swift fox (*Vulpes velox*) have been recently found to occur throughout their historical range in eastern New Mexico, with the exception of areas of high shrub density and cropland (Harrison and Schmitt 1997). To further study the population status and general ecology of swift fox in New Mexico, funding for a three-year research project was approved by the New Mexico Department of Game and Fish and the U.S. Fish and Wildlife Service. The primary goal of current research is to determine the method of population census most appropriate for swift fox in New Mexico. Both relative and absolute estimation methods are being examined. Emphasis is placed upon methods which would be most practical for statewide surveys given the limited financial and labor resources of New Mexico. Secondary goals are to study population density, demographic parameters, home range size, diet, den site selection, and threats to swift fox populations.

Activities this year included selecting a study area, mapping land ownership, obtaining permission to study on private and public land, updating landowners on the progress of the study, purchasing and testing telemetry, capture, and handling equipment, trapping and marking foxes, telemetry, data entry, mapping home ranges, scat collection, lure testing, testing methods of surveys for tracks and scats, testing scent stations with automatic cameras, describing den sites, spotlighting, calling, searching for tracks, and discussions and arrangements with genetics laboratories. Summaries of activities and results are presented below. This report describes activities prior to December 1, 1999. Readers of this report should bear in mind that all conclusions presented here are strictly preliminary.

### STUDY AREA

The western unit of the Kiowa National Grasslands was selected for the study area, based upon the availability of swift fox, typical swift fox habitat, public roads, and extensive public land. The study area is located northeast of Roy, NM, in Harding and Colfax counties. The extended study area covers approximately 484 square miles. Activities to date have been concentrated within a core area of approximately 128 square miles.

Habitat within the study area is entirely short-grass prairie (described as plains-mesa grassland by Dick-Peddie 1993). Dominant plant species are blue grama (*Bouteloua gracilis*), hairy grama (*B. hirsuta*), western wheatgrass (*Elymus smithii*), threeawn (*Aristida* sp.), and needle and thread (*Stipa comata*). The most common shrubs are broom snakeweed (*Gutierrezia sarothrae*) and *Yucca*. Snakeweed is extensive in some sections, but *Yucca* occurs only in isolated stands. Topography is low rolling hills and elevation varies from approximately 1700 to

1900 m (5570 to 6200'). Annual precipitation averages 429 mm (16.9"), with most precipitation occurring as summer rainfall. Average low and high temperatures are 3.1°C (37.5°F) and 18.8°C (65.8°F), respectively.

The study area includes private, state, and federal lands. Land ownership and grazing permittees within the extended study area were identified and mapped through visits to the State Land Office, Kiowa National Grasslands, and Harding and Colfax County courthouses. Ninety individual landowners and permittees were identified. A letter was written to each landowner and permittee describing the project. Included with the letter was a pamphlet describing swift fox. All twenty-nine private landowners within the core area were then contacted by telephone or letter to request permission to enter their land. Permission was granted by all but two landowners. All landowners within the study area have been identified. A second letter was written later to all ninety landowners and permittees updating them on progress of the study. Permission to use New Mexico State Trust land and Kiowa National Grassland was obtained after submission of the study proposal. In addition, permits to capture and handle swift fox were obtained from the New Mexico Department of Game and Fish and the University of New Mexico Main Campus Animal Care Committee.

## METHODS

Two methods to determine the absolute number of foxes within the core study area are being examined: intensive trapping combined with bait stations with automatic cameras, and DNA analysis of scat. Intensive trapping has begun using 25cm x 30cm x 81cm single door traps (Tomahawk Traps, Tomahawk, WI) baited with beef scraps and a cod liver oil - mackerel lure (Trailing Scent, On Target A.D.C., Cortland, IL). Traps are placed at fence, road intersections, or other conspicuous locations and covered with available materials, such as dry weeds or cattle droppings. Captured foxes are transferred to a 30cm x 60cm x 76cm restraint module (Tomahawk Traps, Tomahawk, WI) and sedated before handling. Initially a combination of ketamine (25 mg/kg of body weight) and xylazine (2.5 mg/kg) was used based upon Kreeger (1996), but this resulted in unnecessarily long sedation and depressed breathing and heart rates. Reduction of the dosage to 10 and 1 mg/kg, respectively, did not solve these problems. Telazol (10mg/kg, Kreeger 1996) was found to be more acceptable. It does not depress heart or breathing rates, but may cause excessive salivation and recovery with little warning. Captured foxes are dusted for fleas, inspected for sex and injury, aged (juvenile/adult), measured, fitted with a radio collar (Advanced Telemetry Systems, Isanti, MN, telemetry system described below), and marked for individual visual identification by dyeing a unique portion of their fur with commercial hair dye (Miss Clairol black velvet). Antennas of radio collars were marked with a unique color code with rubber coating. No fox appears to have been harmed by capture or handling.

Radiocollars used were provided by Advanced Telemetry Systems (Isanti, MN). Specifications are model 16MC, current drain 0.11-0.13 mA, pulse rate 55 ppm, weight 44 gm, and antenna length 30 cm. The receiving antenna consists of two five element Yagi antennas

combined 180° out of phase (null) mounted through a sunroof in the cab of the research vehicle. The mounting platform is a modification of a design produced by U.S. Geological Survey (M. Sovada, personal communication). Tests of this configuration indicate that under ideal conditions (ie, both transmitter and receiver on hilltops), the signal may be detected at over 2.5 miles. Accuracy and precision tests using radiocollars at known locations (N = 24) revealed a systematic error of 1.0° and a random error (2 SD) of 1.18°. At one kilometer, with two observations taken at 90° to each other, the 90% error polygon is .0064 km<sup>2</sup> (White and Garrott 1990, p 53), which represents approximately 0.12% of the average home range.

Automatic cameras using active infrared sensors (Trailmaster 1500 with TM 35-1 camera kit and Tm1500 Photo System, Goodson & Associates, Lenexa, KS) at bait stations are being used to locate unmarked foxes. Cameras and receiving sensors are placed in boat dry boxes with holes made to permit photographs and the infrared beam. Dry boxes and the infrared transmitting unit are strapped to wooden stakes driven into the ground. The system is set to take bursts of four photographs no less than two minutes apart when the beam is broken for 0.25 sec.

Technology for identifying species and individuals from DNA in scats has been developed for several species, including some canids (Foran et al. 1997, Kohn and Wayne 1997, Maldonado et al. 1997, Paxinos et al. 1997, Kohn et al 1999). These methods allow not only confident identification of the species producing a given scat, but also of the specific individual. Absolute population estimates may be made using scat and mark-recapture or rarefaction techniques (Kohn et al. 1999). To develop this method for swift fox, five genetics laboratories were contacted (Smithsonian Institution, University of California at Los Angeles, University of Wisconsin, University of Montana, and University of New Mexico). Dr. Jerry Dragoo of UNM has developed much of the technology for swift fox and was chosen to conduct DNA analysis of swift fox scat. Marsha Sovada (U.S. Geological Survey, North Dakota) provided scat and blood control samples to Dr. Dragoo from captive swift fox.

Scats are collected both haphazardly when encountered and during systematic searches. Surveys of roadsides by foot and vehicle and inspection of conspicuous objects and locations (fence corners, cattle guards, gates, utility posts, etc.) were compared for productivity. An examination of the potential for using lures to stimulate defecation is being made by comparing scat collection at locations with a fox lure with collection at locations without a lure.

Trial methods to determine presence/absence and relative numbers of swift fox include trapping, searching for tracks, scent stations, spotlighting, and calling.

Searches for tracks have been found useful in other states (Hoagland 1999, Roy et al. 1999). However, no swift fox tracks have been observed on the study area. Track survey methods have included systematic road surveys, examination of conspicuous objects (see above) and marked sites, and examination of ponds and wet ditches. Track surveys will continue when conditions appear favorable, such as after snowfalls. Tentatively, however, soils in the study area, and probably in New Mexico in general, are too hard, dry, and sandy to take and hold

identifiable swift fox tracks. Tracks have been observed only on prepared surfaces, such as scent stations.

Scent stations have been used successfully in New Mexico and other states to survey swift fox (Olson et al. 1999; Sovada and Roy 1996; Harrison and Schmitt 1997). The goal of testing scent stations is to determine what time period of observation and what spacing between stations is best to detect foxes in an area. Observations of marked foxes provide information on the number of stations and nights required to detect all foxes in an area, and are applicable to situations that may have low fox density. Observations of marked and unmarked foxes combined are most applicable to situations with higher fox density. Automatic cameras that take photographs when an object enters the station (described above) are used to determine if foxes visiting the stations are marked or unmarked. Scent stations consist of 76 cm x 76 cm areas cleared of vegetation and covered with a 1:32 mixture of mineral oil and dried plaster sand. Stations are baited with a plaster of paris tablet (Pocatello Supply Depot, U.S.D.A., Pocatello, ID) soaked in a mixture of cod liver oil and mackerel (Trailing Scent, On Target A.D.C., Cortland, IL) and approximately 4 cm<sup>3</sup> of canned mackerel.

Five scent stations with cameras are placed in a transect within the home ranges of radio collared foxes and observed for six nights. Visitation data is subsampled to determine the percentage of transects visited as a function of number of stations per home range (i.e., spacing between stations) and number of nights observed.

Spotlighting has been used successfully in New Mexico (Harrison and Schmitt 1997) and Kansas (Sovada and Roy 1996) and on kit foxes (Ralls and Eberhardt 1997). Spotlighting on the study area is conducted while driving twice over available roads through known home ranges of swift fox. The area visible by spotlighting comprises a very small portion of a fox's home range and thus this technique is limited by the number of roads available as well as by topography.

Calling has not been previously tested for swift fox, although it has been tested on coyote (*Canis latrans*, Alcorn 1946, Wenger and Cringan 1978, Okoniewski and Chambers 1984). For preliminary tests, tapes of rabbit distress calls and swift fox vocalizations (Cochrane Ecological Institute) were played at various volumes and durations to foxes located by telemetry within 0.5 mile of the observer to determine if foxes will respond.

## PRELIMINARY RESULTS AND DISCUSSION.

Twenty-one swift fox have been trapped (9 M, 12 F) in two trapping periods. In winter (Jan. - Mar.), 8 foxes, including one recapture, were captured in 181 trap-nights (4.4%). Trapping success was higher in fall (Aug. - Nov.), resulting in 19 foxes, including 6 recaptures, during 146 trap-nights (13.0%). To replace collars, four foxes were recaptured in enclosure traps at dens (Covell 1992), which resulted in the capture of one new fox. Seventeen remain alive as of this date (9 M, 8 F), but two are missing. For comparison, trapping success in Colorado was

1.2% in June and 9.2% in October (Kahn and Beck 1996).

Scat were easy to find when an accumulation was present. Most scats were found at conspicuous objects and locations. For example, in one four-hour survey, 35 scats were gathered. During a different survey, 25 scats were gathered from one road intersection, which did include a former scent station and a former trapping site. Some den sites also produced numerous scats. Foot surveys for scats along roads within the home ranges of two foxes produced 3 scats from the roadside and 14 from two dens in 3.4 hours of searching. Vehicle surveys of roadsides for 19.5 miles, including the known home range of one fox, produced 2 scats (both within the known home range). Roadside surveys appear to be very inefficient, especially during summer months when vegetation obscures the roadside. Observations at 35 scented and 36 unscented locations did not reveal any enhancement of scat deposition at scented sites after two weeks. Examination of these sites will continue. Dr. Jerry Dragoo (personal communication) estimated the cost of identifying individuals from 250 scat samples to be \$6300.

Tests of scent stations have been conducted within the home ranges of three marked foxes to date. A total of ninety station-nights of observation were conducted. Swift fox tracks were first observed on the transects after 1, 3, and 4 nights. On two transects, marked foxes left tracks and were photographed after 3 and 6 nights. On the third transect the marked fox was photographed on the first night, but did not leave tracks. No foxes left tracks without being photographed, although foxes were photographed without leaving tracks. Based upon this limited sample of marked foxes, observation of transects of five scent stations for six nights will result in 66% of foxes being detected. For comparison, Olson et al. (1999) detected foxes in the core portions of their home ranges on 88% of transects after 6 nights.

Unmarked and marked foxes combined made 21 visits to stations (23.3%). By subsampling the data, information was gained about the number of transects that would be visited as a function of the number of nights observed and the number of stations per home range. Detection rate increased smoothly as the number of stations per home range and the number of nights observed increased. Based upon this limited sample, to detect foxes in an area by tracks on scent stations, a spacing between stations of 0.4 miles and an observation period of at least four nights is required to detect foxes on all transects on which they are present. However, a spacing of 0.5 mile and an observation period of four nights will detect foxes on 87% of the transects on which they are present.

Spotlighting was conducted for 117 miles through the known home ranges of at least 15 foxes. No foxes were seen. For comparison, Harrison and Schmitt (1997) spotlighted 9 foxes in 3112 miles (1 fox per 345 miles). Spotlighting is a relatively inefficient technique for statewide surveys (Sovada and Roy 1996, Harrison and Schmitt 1997). However, in certain circumstances, such as immediately after crops are harvested, swift fox may be attracted to specific areas where they may be efficiently spotlighted (S. Bremner, personal communication). In New Mexico, spotlighting is useful primarily as a supplement to other methods, particularly during nighttime periods when other methods can not be pursued. Spotlighting will not be tested further.

Six attempts to call foxes within view using recorded sounds were made. No foxes were observed even though telemetry locations indicated that they should have been able to hear the sounds. In open grassland habitat such as that of the study area, it is impossible to approach foxes by vehicle without being detected. Foxes appear to be wary of vehicles and may have been reluctant to approach. One homeowner was disturbed by the sound. Further trials of calling will be conducted, particularly during the mating season.

If DNA methods prove useful, the most efficient method of determining swift fox presence and relative abundance statewide in New Mexico would be scat collection. Scats may be relatively easily found and do not require any response by foxes. Scent stations are more efficient than trapping, but both do readily detect swift fox. The time involved in setting up scent stations and traps is roughly comparable. Trapping provides positive identification of the species trapped, but scent stations do not present any risk of injury. Spotlighting is very inefficient, but may be useful during nighttime periods when it is not possible to pursue other methods. Calling and track surveys appear to be worthless.

Four marked foxes, all females, have died to date. Two were killed by coyotes, but cause of death could not be determined for the other two. One pup was found dead due to a vehicle strike.

Observations of pups have been limited due to the lack of marked females during rearing season. Observations at two dens revealed two pups each.

Average 95% minimum convex polygon home range size for six foxes with over 30 location points is 5.2 mi<sup>2</sup> (1349 ha, range = 619 - 2751 ha).

Potential threats to swift fox on the study site include trapping by U.S.D.A. Wildlife Services agents, vehicle strikes, predation by coyotes and other species, and being shot. Wildlife Services activity occurs only in limited areas, and no swift fox have been reported killed. One swift fox pup was killed by a vehicle on state highway NM 39. The home ranges of two adult marked foxes cross NM 39 and they frequently are close to the highway, but they have not been killed. Two natal dens have been observed within a few meters of a secondary road, but no vehicle deaths were observed. No eagles have been observed on the study site, but coyotes are occasionally observed and have been responsible for at least two deaths. Based upon conversations with ranchers, the attitude of local people toward foxes appears to be very positive and there has been no indication that they would shoot foxes for any reason. Hunting does occur in the study area. Hunters may shoot foxes for sport, but the hunting season is limited to a few days per year. No fur trapping or conversion of grassland to cropland has been noted on the study site yet.

Other swift fox research projects in New Mexico in progress or recently completed include a study of ecto- and endoparasites (Patrick, Harrison, Fagerlund, and Schmitt, in preparation), a den site selection study (Kintigh 1999), and a genetic study within the kit fox-

swift fox hybridization zone (Rodrick 1999).

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